

FACTORS AFFECTING LI-ION CELL PERFORMANCE

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INTRODUCTION

JPL is involved in the development of rechargeable Li-ion cells for future Mars Exploration Missions. The specific objectives are to improve the cell cycle life performance and rate capability at low temperature (<-20 C). Poor cell performance at low temperature can be attributed to electrolytes becoming viscous or solid as temperature is lowered⁽¹⁾. It is also attributed to the poor Li diffusivity in the electrodes. To realize these objectives, work is in progress including material development⁽²⁾ and design optimization. In this paper, we will discuss these issues affecting Li-ion cell performance.

EXPERIMENTAL

The experimental cells were evaluated for charge/discharge characteristics, faradaic utilization of the active material, rate capability and cycle life. The electrodes were made by spraying a solution containing electrode active material, polyvinylidene fluoride (PVDF) binder, and/or carbon black onto a metal foil substrate. The cells were activated with mixed solvent electrolytes containing LiPF_6 salt. Surface morphologies and particle sizes of electrode active material powders were examined using Scanning Electron Microscopy (SEM).

RESULTS AND DISCUSSIONS

One of the many factors controlling Li-ion cell performance is the electrode rate capability. Li-ion cells having the same anode materials and electrolytes and containing LiCoO_2 cathode materials from various sources (Sample 1 and Sample 2) were fabricated. They were then tested at various discharge currents (Fig. 1 & 2). The preliminary results indicated that the cell rate capability is highly dependent on the type/source of cathode material used. From the SEM observation, sample 2 has a smaller particle size and fewer impurities remaining after cathode material synthesis. In this paper, we will report the results of this and several other studies that shed light on factors controlling the performance of Li-ion cells.

ACKNOWLEDGMENTS

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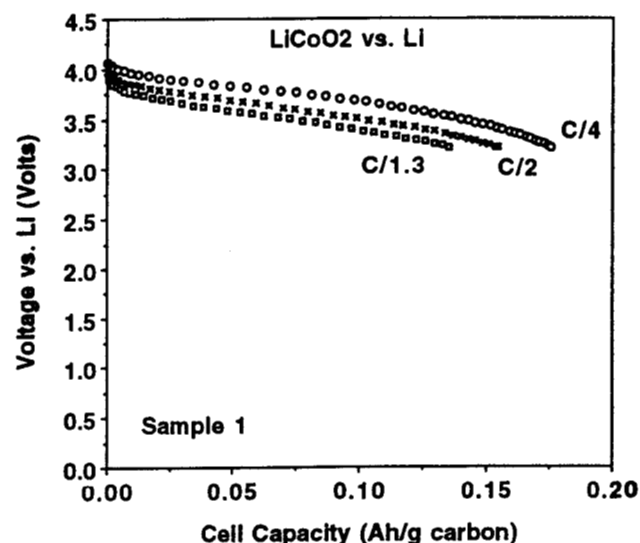


Figure 1. Discharge curves of LiCoO_2 cathode at various discharge rate.

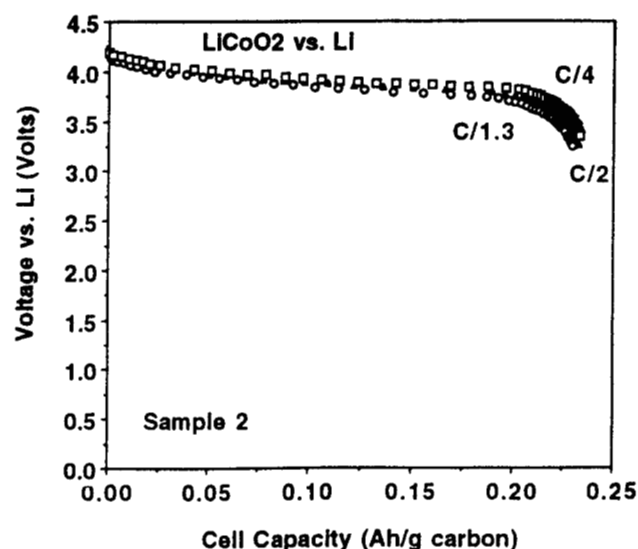


Figure 2. Discharge curves of LiCoO_2 cathode at various discharge rate.